

Health aberrations in children with overweight and obesity

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Valorisation

In addition to the scientific relevance of the studies performed in this thesis, it is important to also discuss the relevance besides science, for instance the relevance in clinical settings, but also the societal and economical relevance. The valorisation of the acquired knowledge about comorbidities of overweight and obesity in children, with a special focus on non-alcoholic fatty liver disease (NAFLD), and the effect of multidisciplinary lifestyle intervention on BMI z-score and comorbidities, are further elaborated in this chapter.

An unhealthy lifestyle and obesity are important causes of morbidity and mortality worldwide. As we have shown in this thesis, and was previously also shown by others (1, 2), the development of comorbidities is already seen at a young age. In addition to physical health consequences, children with overweight and obesity are more likely to suffer from psychological problems, like depression, low self-esteem and decreased quality of life (3). Moreover, children with overweight or obesity are likely to become adults with obesity and the associated comorbidities are also likely to track into adulthood (4). Finally, in addition to the effects of long-term obesity on the health of the individual, there is also a substantial economical and societal burden.

A previous German study has estimated that the expected excess lifetime healthcare costs were higher (3.7 and 5 times higher, respectively in men and women) in adults that were overweight or obese as a child compared to adults that had a normal weight as a child (5). Another previous German study has estimated that a BMI higher than 40 kg/m² in adults is associated with healthcare costs twice as high as in adults with a normal weight. Additional costs for society, mainly due to reduced work productivity, sick leave and long-term incapacity was also twice as high in these adults with morbid obesity (6).

The fact that obesity and the associated diseases like diabetes, cardiovascular disease and NAFLD can have serious consequences on the health of the individual, but also constitutes an economic burden for society, underlines the need for prevention and effective interventions. The results of one of the studies in this dissertation have shown that there was a clinically relevant decrease in BMI z-score and health outcomes improve after one year of on-going, family-based, multidisciplinary lifestyle intervention in children with obesity at the Centre for Overweight Adolescent and Children's Healthcare (COACH). This study also showed that these positive effects, on both BMI z-score and health outcomes, are more pronounced in younger children. At this time, a cost-benefit analysis of the COACH program has not yet been performed, however it is expected that the aforementioned approach contributes to reduced healthcare costs of the treatment of childhood obesity. A recent societal cost-benefit analysis of a two-year multidisciplinary

lifestyle intervention in children with overweight and obesity (in Arnhem, the Netherlands) estimated that the economic benefits of such an intervention are 4-7 higher than the costs (7). In this study, the lifetime economic benefit of lifestyle intervention in children was estimated to be between 11384 and 19120 euros per individual, mainly due to decreased current and future healthcare costs and an improved quality of life due to a decreased disease burden.

In current society, living a healthy lifestyle and losing weight can be a difficult goal to achieve, since unhealthy products and services are easily available. Creating a society in which healthy options are accessible and affordable for everyone, requires combined efforts from stakeholders at multiple levels, like different health care professionals (for instance physicians, dieticians and psychologists), schools, sports clubs, supermarkets and (local) governments.

In the COACH lifestyle intervention, an interdisciplinary team of health care providers works together with various stakeholders to provide a tailor-made intervention for each child and their family. The aim is to achieve and maintain a healthy lifestyle by making small, step-by-step lifestyle changes that can be maintained throughout a long period of time. In order to achieve this, children and their families receive individual guidance, focusing on personalized lifestyle improvements. Of course, intervention programs could be considered costly, because long-term care is provided. In order to limit the costs of this intervention, the intervention plan is tailored to the needs of each child and their family, rather than providing the same plan for all children. In this approach, focus points that are identified before the intervention (and might be adjusted during the intervention) are prioritized together with the family, in order to provide the appropriate guidance at different moments throughout the intervention. Moreover, during the past decade, the COACH program has evolved into an elaborate collaboration with different local stakeholders, such as youth health care, dieticians, a family coach, but also the local municipality, fruit and vegetable farmers and supermarkets. Together with these partners, children are stimulated to lead a healthier lifestyle by participating in sports and healthy food-related activities on a regular basis, in addition to the individual guidance by health care providers. Working together with multiple societal partners that are also motivated in helping to create a healthier living environment for children, contributes to the commitment and success of the intervention.

Based on the experiences of COACH and seven other regional lifestyle interventions in the Netherlands, aimed at guiding children with obesity and their families, a national approach for the care for these children was developed recently ('landelijk model

ketenaanpak voor kinderen met overgewicht en obesitas'). This model provides a basis and step-wise approach for health care providers and societal partners that aim to accomplish a local network collaboration to provide care for children with overweight and obesity. With this national model, the same approach can be expanded to other regions, but also to a broader target group (i.e. children across the entire overweight – morbid obesity spectrum). Expanding the lifestyle interventions that are currently already available for children is necessary to ensure that all children and their families can receive help in achieving and maintaining a healthy lifestyle. Prevention of (increasing) overweight and obesity and the associated health consequences will have a positive effect on the physical and psychosocial health of the individual, but will also help in decreasing the societal burden of obesity (e.g. by decreasing costs and increasing work productivity).

In this dissertation we have not only studied the comorbidities of childhood obesity in general, but also studied non-alcoholic fatty liver disease specifically. The prevalence of NAFLD has strongly increased the past decades, alongside the obesity epidemic. As was discussed in the previous chapters of this dissertation, hepatic steatosis and steatohepatitis (NASH) will progress to liver cirrhosis and liver failure in a subgroup of patients, possibly necessitating a liver transplantation. Also, NAFLD patients have an increased risk of developing hepatocellular carcinoma, illustrating that the disease can have severe consequences for the health of the individual. Finally, NAFLD has been associated with an increased risk for developing cardiovascular disease and diabetes type II. These findings underline the importance of early recognition of NAFLD patients.

A recent study showed that between 2006 and 2016, the number of NAFLD-related liver transplantations increased by 170% in the United States, making it the second leading cause of liver transplantation (8). Currently, weight loss through lifestyle improvements is the recommended treatment for children with NAFLD. Therefore, lifestyle interventions, such as the COACH program, can contribute to decreasing disease severity and preventing progression to severe disease states that might require a liver transplant. However, since weight loss is currently the only proven treatment for NAFLD in children, there is an urgent need for other treatment options to prevent progression to severe stages of the disease, especially in patients that experience difficulties in achieving and maintaining weight loss.

NAFLD is often asymptomatic and most patients do not have specific symptoms until they have progressed to the severe stages of the disease spectrum. Currently, the gold standard for diagnosing and staging non-alcoholic fatty liver disease is a liver biopsy. Since

this is an invasive procedure with a small risk of severe complications, liver biopsies are not suitable for screening the large number of people that are at-risk for developing NAFLD. As mentioned previously in this dissertation, other diagnostic modalities are less suitable for screening purposes or have limited sensitivity for staging NAFLD. Therefore, an increased insight in the children that are at risk for (progressive) NAFLD can help in an early clinical recognition of these children, in which prevention of further weight gain and metabolic disturbances is very important. In the studies in this dissertation, we have evaluated parameters that are associated with the different stages of NAFLD in children with overweight and obesity. An increased insight into the factors associated with NAFLD development and progression can also help in the development of new treatment modalities.

In addition to affecting the individual, the health consequences associated with NAFLD also have significant economic consequences. It was recently estimated that the direct annual economic burden of NAFLD in 4 European countries (Germany, France, Italy and the United Kingdom) was 35 billion euros. When combined with the societal costs of the loss of quality adjusted life years due to NAFLD and its complications, the annual economic burden was estimated to be 228 billion euros. Costs due to a loss in work productivity were not taken into account in this estimation. Also, this study did not investigate whether the economic burden was dependent or independent of obesity (9). It is to be expected that early recognition of patients that have developed NAFLD, increased insight in the risk factors for (fast) progressive disease and new treatment options contribute to a decreased burden on the healthcare system, including liver transplantations, and a decreased societal economic burden.

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